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Application of the Fuzzy Neural Network Algorithm in the Exploration of the Agricultural Products E-Commerce Path

Shuangying Liu[1], Weidong Zhang[2,*]

[1]School of Trade and Economics, Jilin Engineering Normal University, Changchun 130052, China
[2]College of Mechanical Engineering, Jilin Engineering Normal University, Changchun 130052, China
Address: 3050 Kaixuan road, Changchun

ABSTRACT
The constant development of computer technology has greatly facilitated our life. In the past, the agricultural products trade and agricultural products business model were an offline development, through face-to-face transactions. However, with the continuous application of Internet technology, we also have a new exploration on the e-commerce path of agricultural products. The fuzzy neural network algorithm was used to study the electronic commerce path of agricultural products and helped us to carry out the exploration computation of the electronic commerce path of agricultural products. And good calculation results have been obtained. Through our testing of the fuzzy neural network algorithm, the computational efficiency and feasibility of the algorithm have been proven.

KEY WORDS: Fuzzy neural network algorithm; the e-commerce of agricultural products; path exploration.

1 INTRODUCTION

WITH the continuous development of computer technology, various fields gradually start to connect with the computer network. By associating with the products of this new era, it further influences the development of this field (Rubaai A et al, 2016). This is the case with the study of the e-commerce paths of agricultural products. The traditional trading mode of agricultural products is generally offline, which is not only bad trading results, but also time-consuming, and it occupies a lot of manpower and material resources, and the price of goods fluctuates greatly (Sotirov S et al 2017). The waste of time can affect the profit margin, and farmers and businessmen will be affected variously. The trade of agricultural products in the form of e-commerce will not only help farmers to master real-time prices of agricultural products, but also save trading time and kills two birds with one stone. The exploration of the e-commerce of agricultural products can also enable farmers to have enough information to analyze future crop sales before planting crops (Azari M et al 2016).

The path exploration of agricultural products has been studied by the fuzzy neural network algorithm. The computational research of the fuzzy neural network algorithm was first about the analysis of the calculation procedure of the fuzzy neural network calculation (Ma X et al 2017). Before the study of the fuzzy neural network algorithm, the computational research of the BP neural network algorithm has been analyzed, because the fuzzy neural network algorithm is based on the BP neural network algorithm (Mansouri I et al, 2016). Then the fuzzy neural network algorithm began to be optimized and improved moderately, and it is more advanced to the computational research of this paper through our improvement (Si L et al 2016).

The specific contributions of this paper include: The fuzzy neural network algorithm is used to study the e-commerce path of agricultural products. A good calculation result is obtained. The fuzzy neural network algorithm is optimized, and the test of the fuzzy neural network algorithm is carried out. The computational efficiency and feasibility of the algorithm are proven.

The rest of this paper is organized as follows: Section 2 discusses related work, followed by the fuzzy neural network algorithm and the application method of the fuzzy neural network model is analyzed in Section 3. The simulation experimental results of the fuzzy neural network model are discussed in Section 4. Section 5 concludes the paper with summary and future research directions.

CONTACT Weidong Zhang ez9088@163.com

2 RELATED WORKS

THE computational research of the fuzzy neural network algorithm is based on our original BP neural network algorithm (Lin F J et al 2016). In the 1950s, we gradually began computational research on the BP neural network algorithm. After twenty years of research, we have started a new research direction, which is the fuzzy neural network algorithm. The fuzzy process of the fuzzy neural network algorithm was a great improvement and optimization of the traditional neural network algorithm. American scholars have expanded many fuzzy computations about algorithms after years of computational research, and the fuzziness of the neural network algorithm was a very typical calculation, and it provided a calculation basis for calculation and optimization for a lot of our computational research (Khademi F et al, 2017).

The computational research of the fuzzy neural network algorithm in China was carried out in the 1990s with the computational research of the BP neural network algorithm. Because of the limitation of computer technology in the early stage, the researches of this field have lagged behind advanced western countries. But after two decades of computational research, the calculation of the fuzzy neural network algorithm in China was as mature as the BP neural network algorithm (Ghoreishi S M et al, 2016). We can apply the fuzzy neural network skillfully to the analysis of various calculations. The calculation application of the fuzzy neural network algorithm in this paper was a very typical calculation. The calculation of this paper was based on the calculation of the traditional algorithm and was optimized, and the advantage was greater (Dong Q et al 2017).

3 METHODOLOGY

3.1 Research on the BP Neural Network Algorithm

FOR the entire computer algorithm use domain, the BP neural network algorithm is widely used. Because the BP neural network algorithm appeared early, it was also one of the longest algorithms we have studied. This algorithm is a scientific computer algorithm that is simplified and developed after studying the neural network of natural organisms. By simulating the methods and functions of information transmission and information processing of the biological nervous system in nature, it can help us to calculate some specific problems in real life.

The main structure of the neural network algorithm is similar, and the BP neural network algorithm is also similar, and mainly consists of three parts; output layer, hidden layer and output layer. These three big structures support our calculation process. The most important of these is the hidden layer, which is like the neurons in our biological neural network, and the input layer is like the synapse, and the output layer is like the cell in which information is passed. The whole algorithm is like the reduction of biological nerve cells. Our computational process is certainly not consistent with the computational process of our biological neurons, so we must go through our self-consistent assumptions then it can be used for computation. Let's begin our detailed introduction.

The BP network learning made the error between the actual value of the output layer and the expected value come down to the “error” of each layer of every artificial neuron connection weight and threshold value. The error is reversely passed into the input layer, layer by layer. The error is “distributed” to each layer of each neuron to calculate the reference error. The learning process of the BP network is divided into two steps. The first step is to enter the training sample, set the connection weight and threshold value of the first iteration, and the output of each artificial neuron would be calculated backwards step by step from the input layer of the network. The second step is to modify the connection weight and threshold value. The influence degree of each connection weight and threshold value on the total error is calculated from the output layer. Subsequently, each connection weight and threshold value would be modified. The above two processes alternate repeatedly until the error reaches the target error set. The calculation of the adjustment amount of the connection weight and threshold value of each layer of every neuron is as follows:

If $x_1, x_2, x_3, \cdots x_n$ are the information inputs of the optic nerve elements and $w_{i1}, w_{i2}, w_{i3}, \cdots w_{in}$ are the weight coefficients between the i neuron and $x_1, x_2, x_3, \cdots x_n$,Yi is the output of the i neuron. The excitation function f determines the output mode. The output relationship can be described as:

$$I_t = \sum_{j=1}^{n} w_{ij} x_j - \theta_i \tag{1}$$

Change:

$$I_t = \sum_{j=0}^{n} w_{ij} x_j , \quad \mathrm{w_{i0}} = -\theta_i \text{ } \mathrm{x_{i0}} = 1 \tag{2}$$

Let $x_i(t)$ be the input information of neuron i received by neuron j at time t. $o_j(t)$ is the output information of neuron j at time t. The expression of neuron state can be expressed as:

$$\mathrm{o_j}(t) = f\left(\left[\sum_{i=1}^{n} w_{ij} x_i\left(t - \tau_{ij}\right)\right] - T_{ij}\right) \tag{3}$$

There into:

τ_{ij} is the outstanding delay between the input and output, and T_j is the threshold value of the neuron, and w_{ij} is the weight Value, and f is the neural mapping rule.

The following formula is the time integration that neurons do not take into account, and there is the formula to make up.

$$met_j(t) = \sum_{n=1}^{n} w_{ij} x_i(t) \quad (4)$$

For the BP neural network algorithm, our calculation process is relatively simple. Of course, it is relative to the fuzzy neural network algorithm. The computer calculation process of the BP neural network algorithm is shown in Figure 1. Through the calculation model in the below figure, we cannot only calculate the BP neural network algorithm, but also study the fuzzy neural network algorithm that we really want to study in this paper through further optimization.

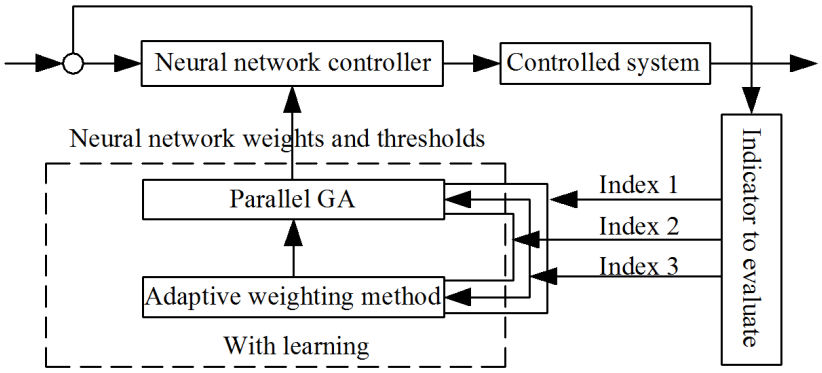

Figure 1. **The BP Neural Network Algorithm Computer Computing Process.**

3.2 The Fuzzy Neural Network Algorithm

Fuzzy neural networks are compared to traditional neural networks, and the fuzzy neural network has two more processes than traditional neural networks. These two processes are; the process of blurring and clarifying information. The steps we are studying are consistent with the algorithms used in the previous calculations. In any case, in the course of our study, the deformation of the previous artificial neural network algorithm, and the fuzzy neural networks, we understand, are like the artificial neural networks. The way our human brain processes problems in the nervous system is to mimic the way the human body processes information. As we all know, the artificial neural network is divided into three parts, namely, the input, output and processing unit. The previous information transmission process was both bidirectional, and the input was the output in the process of our study. Next, we will introduce uniformly the detailed formula of the fuzzy neural network algorithm. And in order to ensure the accuracy of the settlement results in the future, in the study, we will have a detailed description of the exact simulation and hypothesis. The hypothetical mechanism is shown in Table 1. Our hypothetical condition is the computational condition of the algorithm.

Table 1. **The Artificial Neuron Network Assumed Method.**

Assume the node	Assuming mechanism	The original mechanism
Information processing	Multiple input single output	Multi-input multiple output
Type of input	Excitement and suppression	Multiple types
Spatial characteristics	With spatial characteristics and thresholds	No
Output time	fixed	Non-fixed
Neurons	Non-time-varying	time-varying

In all of our research on artificial neurons, they consisted of three basic elements; a set of connections, a summation unit and a non-linear activation function. In biology, the study of the biological neurons corresponds to the corresponding synapse. Weights on each node represent the connection strength. If we want to know what the state of activation, we see that the weights are positive. Instead, we see that the

weights are negative and that is the inhibitory method. The sum unit of the artificial neural network is the mapping function to obtain each input signal of the weighted and nonlinear activation function. This effect is conducive to simulate the establishment of the artificial neural networks. We control the neuron output amplitude within a certain range. The magnitude of a value, showing its function is different, and these functions we can substitute them as mathematical expressions:

$$Y_j(t) = \phi\left(\sum_{i=1}^{n} w_{ji} x_i - \theta_j\right) \quad (5)$$

There into, x_i is the input signal, and w_j is the link weight of the neuron j, and θ_j is the threshold value, and Y_j is the output of the neuron j, and φ is the activation function.

Let $x_i(t)$ be the input information of neuron i received by neuron j at time t. $o_j(t)$ is the output information of neuron j at time t. The expression of the neuron state can be expressed as:

$$o_j(t) = f\left(\left[\sum_{i=1}^{n} w_{ij} x_i\left(t - \tau_{ij}\right)\right] - T_{ij}\right) \quad (6)$$

The neural network algorithm mentioned in this paper is supervised learning. The learning pattern is shown in below Figure 2. As the below chart shows, when we enter information into a fuzzy neural network algorithm, we will calculate the advancement first and analyze the results. Finally, the result is the output as the final result of the algorithm. Our previous expectations are compared to what we are looking for now, and find the most obvious difference, and the difference values would be done by weight analysis, and to repeat this operation to reduce the expected value and the calculated value. Finally, the results are the same. We received the experimental results that we needed.

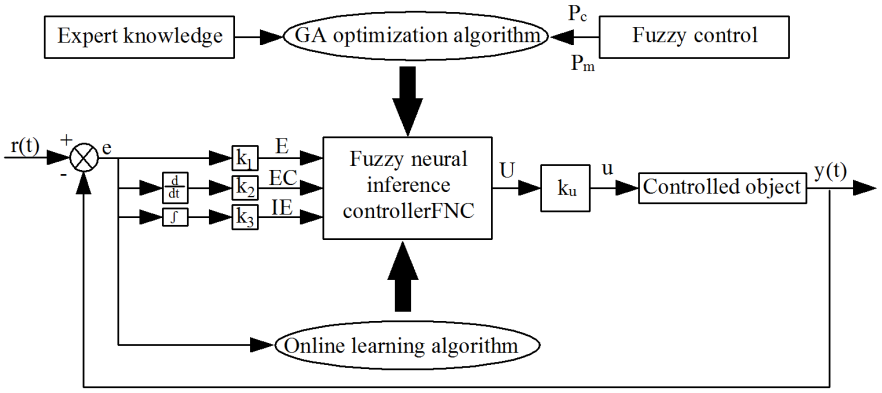

Figure 2. This Article uses the Neural Network Algorithm Learning Model.

The calculation of the fuzzy neural network algorithm is over. Now we are going to explore its advantages. The first thing we see is the calculation is particularly simple, but the results are accurate. In actual use, our technical personnel said this algorithm shows a particularly high time efficiency. Every algorithm is different. But compared to other traditional algorithms, this algorithm is not only efficient but also accurate, and we can see the consistency of the results. The combination of the traditional algorithm and the optimized two algorithms can enable us to calculate more accurately and quickly in the calculation, and speed and accuracy are also enough.

4 RESULT ANALYSIS AND DISCUSSION

WE have completed the calculation process and the calculation formula of the BP neural network algorithm and the optimized fuzzy neural network algorithm. Next, we need to test the fuzzy neural network algorithm for our study. This paper tests the five aspects of the calculation process: Computation time, accuracy in computation, the result offset of the computation, degree of membership function and the PID control. Tests were carried out in a comparative experiment. The test of this paper was simulated with Matlab 7.0 software. We set up five sets of experiments, each of which produced different amounts of calculation, and other factors were the same. This was to ensure that the variables in the test process were unified. Table 2 is the comparison table for our test results.

Table 2. Test Results Comparison Table.

Algorithm	Test group	Calculating time	Accuracy	Calculation result offset
Traditional algorithm	Group 1	56	98%	0.23
	Group 2	64	74%	0.25
	Group 3	74	70%	0.25
	Group 4	84	65%	0.24
	Group 5	98	61%	0.25
Optimized algorithm	Group 1	23	97%	0.11
	Group 2	29	96%	0.13
	Group 3	34	99%	0.13
	Group 4	38	97%	0.12
	Group 5	42	95%	0.11

The calculating time between the traditional algorithm and the optimization algorithm is shown in Figure 3.

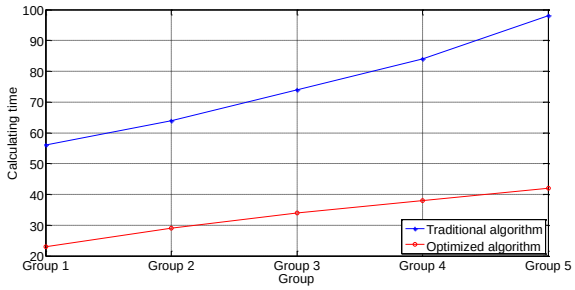

Figure 3. The Calculating Time between the Traditional Algorithm and the Optimization Algorithm.

The accuracy comparison between the traditional algorithm and the optimization algorithm is shown in Figure 4.

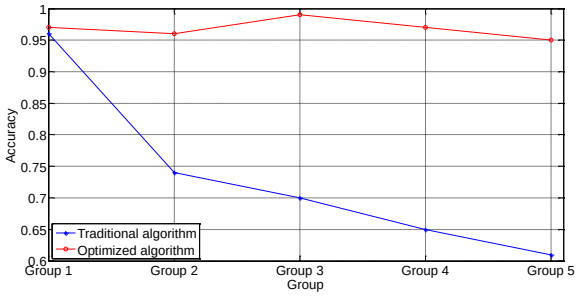

Figure 4. The Accuracy Comparison between the Traditional Algorithm and the Optimization Algorithm.

The calculation result offset between the traditional algorithm and the optimization algorithm is shown in Figure 5.

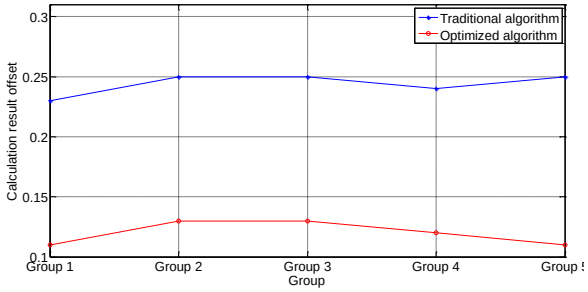

Figure 5. The Calculation Result Offset between the Traditional Algorithm and the Optimization Algorithm.

Through our observation and research of the above test results, we find that the calculation of our optimized algorithms is much better than the traditional algorithms in every aspect. In terms of computing time, the amount of computation increased according to the increased muscle of the calculated group in our counting process, so the computation time of both algorithms increases with our calculation. But we can see that with the increase of the computation, the computation time of our optimized algorithm only increased from 23 seconds to 42 seconds. However, the traditional calculation time only increased from 56 seconds to 98 seconds. Through our optimization, we have optimized our computing time by half the time of the traditional algorithm. The optimization effect was good, and we also achieved our initial goal of computing. The calculation time increases, not only the calculation time is shorter, but also the calculation time increase rate is also smaller.

In addition, we also compared the calculation accuracy. The calculation accuracy of the traditional neural network algorithm decreased with the increase of our calculated amount. The accuracy of the calculation dropped from 98% to 61%. Obviously, this kind of traditional algorithm cannot be used for the calculation of large amount of data, and the calculation accuracy was low. However, through our optimization, our calculation accuracy has not changed significantly with the increase of the calculation term, and it kept a highly accurate calculation more than 95.6% all the time. This accuracy algorithm has completely satisfied our requirements for calculating accuracy. It showed that our algorithm had satisfied our use requirement in calculating accuracy. In addition, our analysis of the offset of the calculated results, and the offset of the calculation result of the traditional algorithm is twice the offset of our optimized calculation result. If the calculation result is too large the computation results were unstable in our calculations. There may be some

large data bias that directly affects the availability of our results. The offset of the calculated results of our optimized algorithm did not exceed 0.13. The effect of this offset on the stability of our overall calculation results was not very large and satisfied the accuracy requirement of the calculation result. Our optimization of this aspect was successful.

In addition, the PID control was also studied. It was found that the PID control of the fuzzy neural network is much less than in which it did not control. The stability was better and converged to a stable value. As the computation time was increasing, the PID of the calculation gradually stabilized to 1. It's going to be stabilized to 1 in about 0.25 seconds. We set the relationship diagram between the specific PID and the computation time in Figure 6 below.

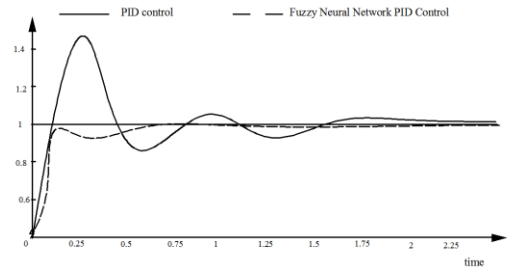

Figure 6. The PID and Calculation of the Relationship between the Times.

The problem of the degree of membership function was studied. For the calculation of the degree of membership function, we used the traditional fuzzy neural network algorithm to contrast the test with the optimized fuzzy neural network algorithm. Then the relationship between the degree of membership function of the two and the calculation time was established in Figure 7. By observing Figure 7, we find that the calculation of the degree of the membership function of the optimized algorithm reaches our extreme value faster. The degree of the membership function of the traditional algorithm took longer to reach the extreme value.

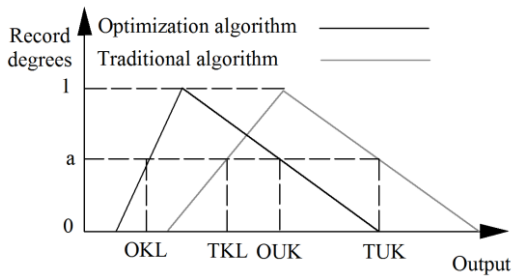

Figure 7. The Records of the Degree of Possession and the Time before the Relationship.

Through the above test experiment, we have proven the success of our optimized fuzzy neural network algorithm. Not only was the calculation time shorter, but the calculation was more accurate, and the offset of the calculated result was small. The calculation of the PID control and the degree of membership function also met our requirements. The optimized algorithm was an effective algorithm.

5 CONCLUSION

WITH the development of modern technology, the application of computer technology is more and more extensive. Various fields are gradually beginning to be combined with computer technology. The marketing of agricultural products has gradually begun in research of the e-commerce. In the form of the e-commerce, the sales and consumption of agricultural products are more organized. This paper used the fuzzy neural network algorithm to explore the e-commerce path of agricultural products. By us for the optimized fuzzy neural network algorithm for testing, it was found that the added amount of the computation time of the algorithm was small, and added almost 10 seconds at a time, computing accuracy also had been kept in more than 95% all the time. The calculated result offset was less than 0.13, and the PID converged faster. It started to converge to 1 in about 0.25 seconds. In addition, the time of reaching the extreme of the degree of the membership function of the optimized fuzzy neural network algorithm was shorter. To summarize, our application of the fuzzy neural network algorithm was feasible and can help us to explore the path of the agricultural product e-commerce. However, our optimized algorithm is not optimized to the extreme, there is still room for further optimization, and we will continue to work.

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8 DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

9 NOTES ON CONTRIBUTORS

Shuangying Liu (1969), Received Master's degree. Graduated from the Northeast Normal University, majored in electronic commerce, associate professor. Research interest: E-commerce, rural economy. Work unit: Jilin Engineering Normal University.

Weidong Zhang (1968), Jilin Tongyu, lecturer, Master of Economics., Research interest: Economics, Communication. Work unit: Jilin Engineering Normal University.